DOCUMENT INFORMATION

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Document No: 24590-WTP-PER-J-02-001	**Rev:** 1

Project Information (Check Applicable Box)

- ☐ Balance of Facilities
- ☐ Pretreatment
- ☐ HLW Vitrification
- ☐ LAW Vitrification
- ☐ Analytical
- ☐ External Interfaces
- ☒ Across all areas

Document is applicable to ALARA? ☒ Yes ☐ No

In general, any record that deals with Radiation, Radioactive Material, Occupational Dose, Dose Reduction, or Dose Rate are considered ALARA Records. (See 24590-WTP-GPP-SRAD-002, *Application of ALARA in the Design Process*, section 4.8 for additional guidance)

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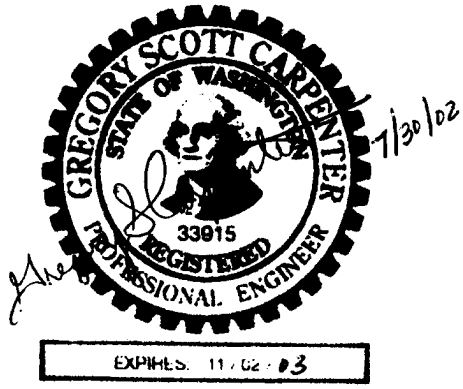

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Signature Date 7/30/02

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0	28Jun02	Issued for Permitting Use	MAD/NJS
1	29Jul02	Issued for Permitting Use (added dry sump – radar)	KDS/NJS

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1 Introduction

The purpose of this document is to satisfy WAC 173-303-640(4)(c)(iii), in compliance with Ecology permit conditions III.10.E.9.b.ii. The scope of this document covers the description of the level measurement technology employed for leak detection, in secondary containment sumps. The installation and functional testing of leak detection systems is also described herein.

2 Applicable Documents

None

3 Description

3.1 Wet Sump Leak Detection Design

3.1.1 Pretreatment Facility El. –45'

3.1.1.1 Leak Detection Method

The PTF C5 Cell Wet Sump PWD-SUMP-00040 in the process Pit is located at Elevation –45'. The sump will be maintained at a minimum level to maintain a hydraulic seal between the overflow line from vessels PWD-VSL-00033 and PWD-VSL-00043. PWD-SUMP-00040 is the only sump in the PTF that is maintained at a minimum operating liquid level. All other sumps within PTF are maintained dry during normal operating conditions. The sump leak detection method will use two bubblers, PWD-LT-1201 and PWD-LT-1202. Each bubbler will alarm on "low level", to the Plant Control System, which will prompt the operator to restore the minimum operating liquid level. Each bubbler will also initiate an alarm signal "high level", to the Plant Control system, when the level of the sump is greater than a nominal level in the sump. A "high level" alarm infers that there has been a breech in the primary containment and that process fluid is in the sump. The bubblers shall alarm to the Plant Control System on either loss of power or loss of purge flow to ensure that the necessary inputs are available for the leak detection system to function as intended. The loss of power or purge flow will be detected through a loss of data quality signal sent via the Foundation Fieldbus data protocol.

Once a "high level" alarm is initiated, the operator will be responsible for emptying the sump via one of the two steam ejectors located in the sump. The steam ejectors are designed with enough capacity to empty the cell sump within 24 hours. After the sump has been emptied, the sump and associated piping shall then be cleaned and a normal sump level re-established. The level setpoint will be reset to reflect the new liquid level in the sump.

3.1.1.2 Installation and Functional Testing

The differential pressure transmitter of each bubbler shall be located at least one barometric head above the bottom of the tube. This minimizes the possibility that the transmitter will be contaminated due to the sump contents. Since the transmitter is located in a C3 area, maintenance will be possible. The transmitter shall be calibrated during commissioning and periodically throughout the life of the instrument. The communication between the transmitter and the Plant Control System shall also be verified and maintained throughout the life of the instrument. The addition of plant wash and an increased level reading will be used to support the verification of transmitted level. The use of the steam ejector and a decreased level reading will also support the verification of the leak detection system. Figure 1, shows a general sketch regarding the installation of the leak detection instrument. As shown in Figure 1, the sensing lines will go through a shielded wall/floor box to protect the instrument along with personnel conducting maintenance operations at the transmitter from the radioactive environment of the cell. The instrument air purge flows will be controlled by flow regulators which, once set, will provide a constant flow to the leak detection instrument.

The piping into the process shall be welded pipe. The pipes will also have the ability to be flushed with solution to eliminate buildup of solids in the sensing lines.

Once installed, the leak detection system including all instrumentation, piping, and other associated equipment shall be tested as a system, before startup and periodically thereafter to ensure that the leak detection system meets the leak detection criteria for PWD-SUMP-00040. The test will include filling the sump to simulate levels. At the minimum, the "low alarm" level, the "normal operating" level, and the "high alarm" levels will then be checked and verified for the proper indication and alarm response. The Foundation Fieldbus data communication will constantly monitor and perform diagnostics on the leak detection instruments, alarming on loss of power, communication, and purge flow. Tests simulating a loss of power, communication, and purge flow will be conducted to ensure the diagnostic ability of Foundation Fieldbus.

3.2 Dry Sump Leak Detection Design

3.2.1 Waste Treatment Plant Facilities (except Pretreatment Facility El. –45')

3.2.1.1 Leak Detection Method – Radar Level Detection

The sump leak detection method will use one radar level detection device/transmitter. The radar level detection device shall have a "high level" alarm. A "high level" alarm infers that there has been a breech in the primary containment and that process fluid is in the sump. The radar device shall alarm to the Plant Control System on loss of power or malfunction assuring the leak detection system functions as intended. The loss of power will be detected through a loss of data quality signal sent via the Foundation Fieldbus data protocol.

Once a "high level" alarm is initiated, the operator will be responsible for emptying the sump via the sump's emptying method. Examples of sump emptying methods include, but are not limited to, steam ejectors, and various sump pumps. The sump's emptying method shall be designed with enough capacity to empty the cell sump within 24 hours. After the sump has been emptied, the sump and associated piping shall then be cleaned.

3.2.1.2 Installation and Functional Testing

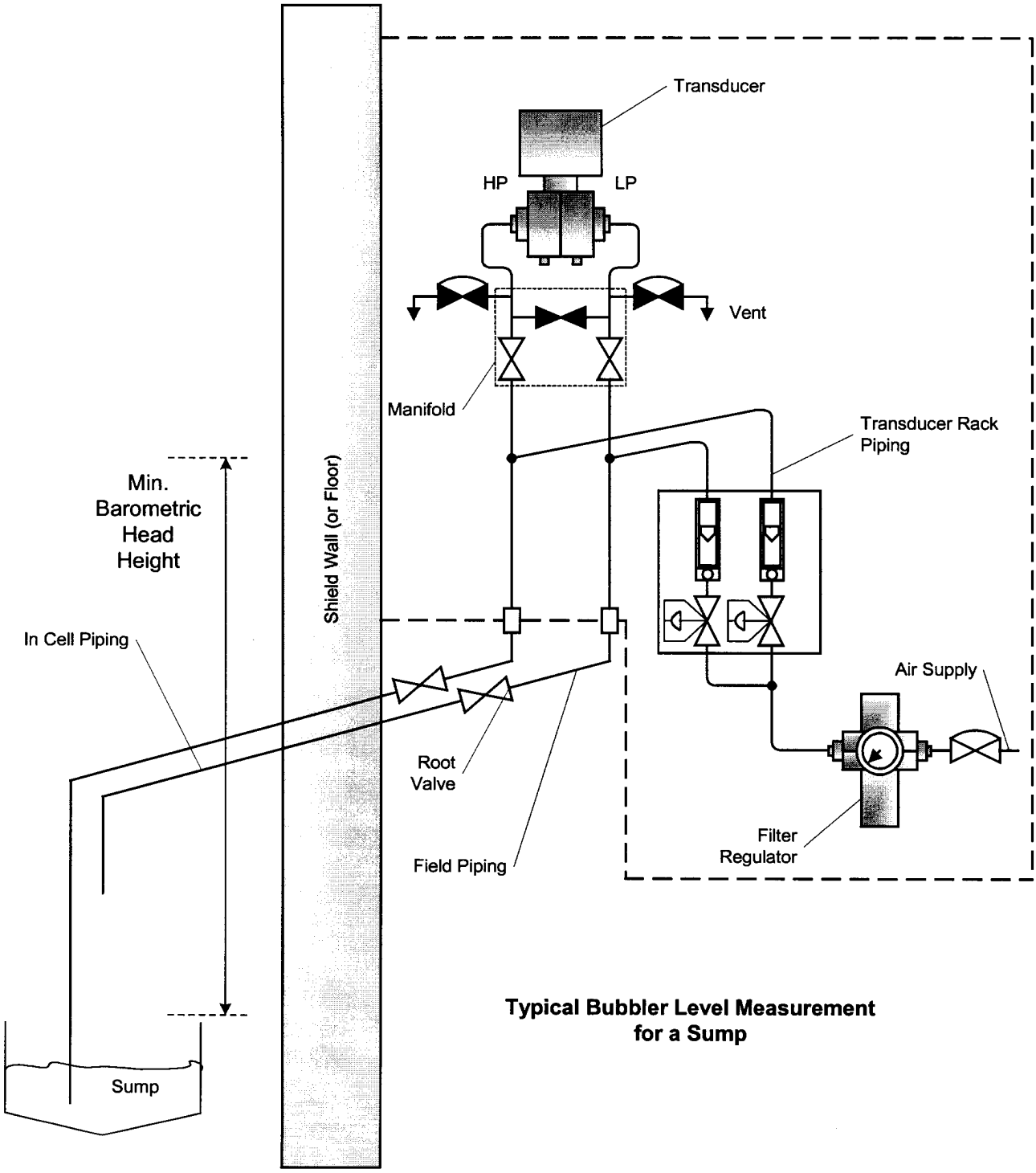
The radar transmitter shall be located in a C3 or C2 area, where maintenance will be possible. The transmitter shall be calibrated during commissioning and regular maintenance/recalibration shall be

performed as recommended by the vendor. The communication between the transmitter and the Plant Control System shall also be verified and maintained throughout the life of the instrument. The addition of plant wash to the sump and the incidental increased level reading will be used to support the verification of transmitted level. The use of the sump's emptying device and a decreased level reading will also support the verification of the leak detection system. Figure 2, shows a general sketch regarding the installation of the leak detection instrument. As shown in Figure 2, the wave guide will go through a shielded wall/floor box to protect the instrument along with personnel conducting maintenance operations at the transmitter from the radioactive environment of the cell. The wave guide shall be installed such that the wave guide touches the bottom of the sump and with the bottom of the wave guide open and slotted, insuring earliest leak detection possible. Figures 3 & 4 show the radar sump level detection in a C3 or C2 area, where the transmitter will be in the same room as the sump. Figure 3 shows the radar with a wave guide tube, installed to bottom of sump with the bottom of the wave guide open and slotted. Figure 4 shows the radar with a horn, non-contact through air, setup. Various types of horns, antennas, and wave guides may be used.

The piping (wave guide) into the process shall be welded pipe, per vendor specifications. The pipes shall have the ability to be flushed with solution to eliminate buildup of solids in the sensing lines.

Once installed, the leak detection system, including all instrumentation, piping (wave guides), and other associated equipment shall be tested as a system, before startup and periodically thereafter, to ensure that the leak detection system meets the leak detection criteria for the appropriate sump. The test will include filling the sump to simulate levels. At the minimum, the "high alarm" levels will be checked and verified for the proper indication and alarm response. The Foundation Fieldbus data communication will constantly monitor and perform diagnostics on the leak detection instruments, alarming on loss of power, and communication. Tests simulating a loss of power, and communication will be conducted to ensure the diagnostic ability of Foundation Fieldbus.

Figure 1 Bubbler Level Measurement for Sumps



Typical Bubbler Level Measurement for a Sump

Figure 2 Radar Level Measurement for In-Cell Sumps

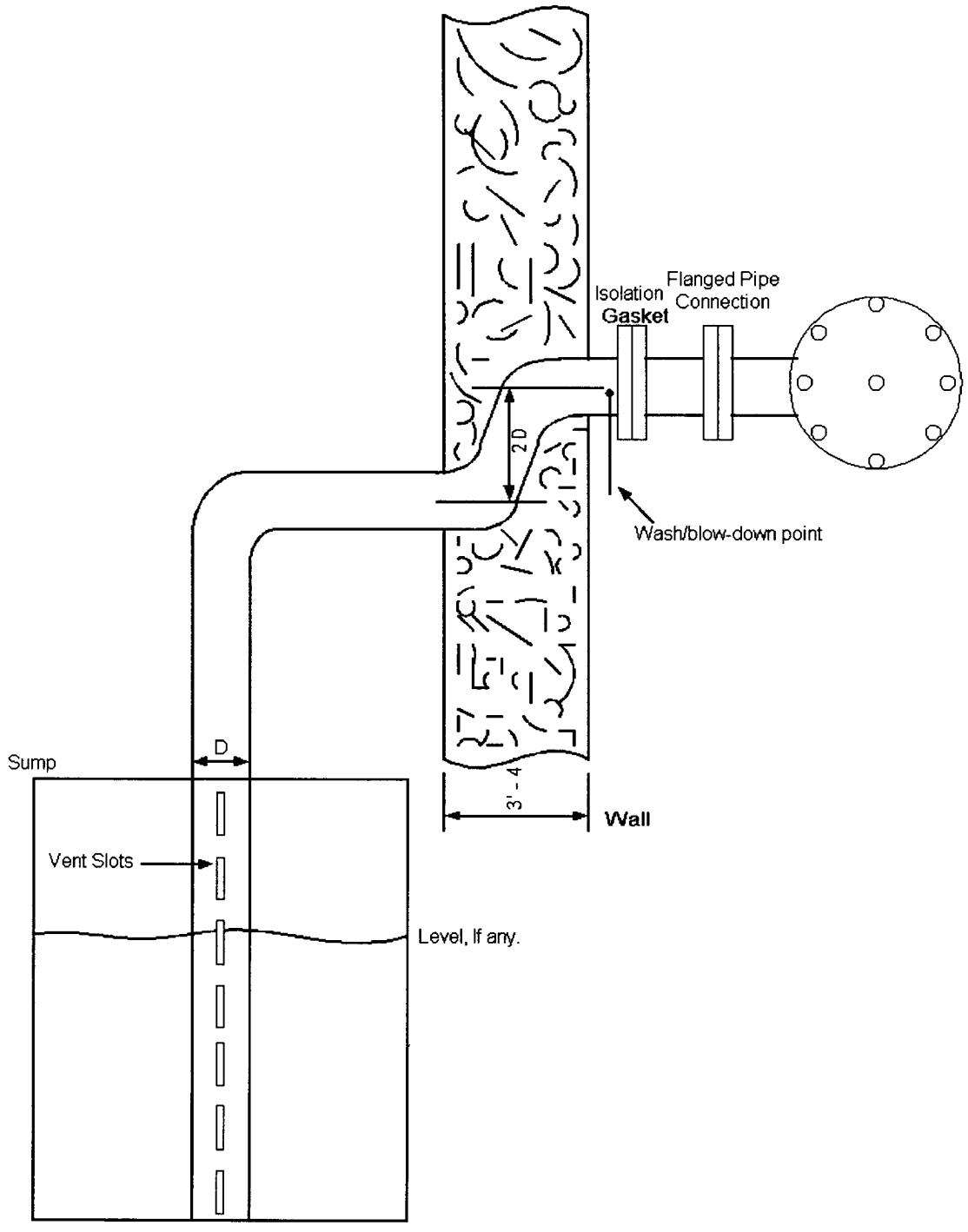


Figure 3 Radar Level Measurement for Out-Cell Sumps – Extended Waveguide

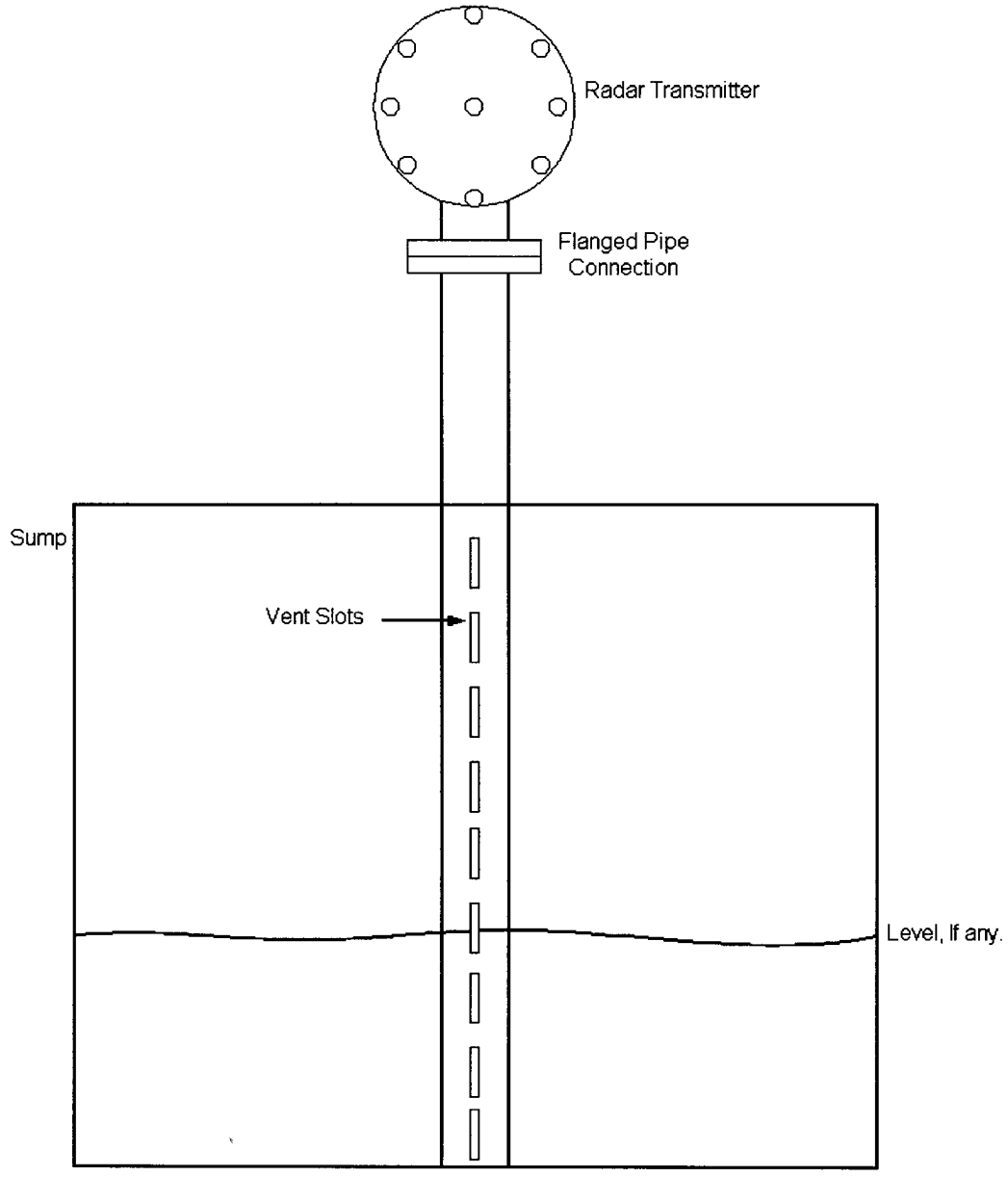


Figure 4 **Radar Level Measurement for Out-Cell Sumps – Horn**